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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/626,320	07/24/2003	Yoshitaka Masutani	16NM02038	1342

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EXAMINER	
ROZANSKI, MICHAEL T	

ART UNIT	PAPER NUMBER
3768	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/626,320	MASUTANI ET AL.	
	Examiner	Art Unit	
	Michael Rozanski	3768	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

Applicant's submitted RCE and amendments to the current claims are acknowledged.

Response to Arguments

1. Applicant's arguments with respect to claims 1-20 have been considered but are moot in view of the new ground(s) of rejection. Applicant asserts that Mori does not describe or suggest a fiber rendering apparatus including a device for defining points obtained by randomly moving grid points based on a distribution function. However, Pierpaoli et al teach of adding simulated noise in the MRI measurement to diffusion weighted image signal intensities based upon a Gaussian distribution, as is further described below.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 5-7, 9-12, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori (US 6,526,305) in view of Pierpaoli et al (US 5,969,524).

With regards to claims 1 and 5, Mori teaches in the abstract of "A method of creating an image of brain fibers includes exposing the brain fibers to a magnetic

resonance imaging process. The data acquisition from the magnetic resonance imaging includes the acquisition of diffusion-weighted, images that are later employed to calculate an apparent diffusion constant at each pixel along more than six axes. The data is introduced into a microprocessor which calculates six variable in a diffusion tensor and obtains a plurality of eigen values and eigen vectors. This may be accomplished by employing a diffusion sensor which is diagonalized to obtain three eigen values and three eigen vectors with the six values being subjected to further microprocessing to generate imaging information representing the properties of the fibers" (abstract).

Mori teaches of "The fiber tracking, on the other hand, is performed in a continuous number field by referencing nearby three-dimensional discrete data grids" (column 4, lines 49-52 & Figure 6).

Mori teaches of the start point and endpoint tracking neighborhood point analysis when describing "the process in a preferred embodiment includes the initiation of fiber tracking by selecting a pixel for initiation of the same, connecting of pixels and effecting a judgment regarding termination of the pixel tracking in each direction based upon the randomness of the fiber orientation of the adjacent pixels" (abstract).

Displaying of the images can be seen in figures 4-5 and 7.

With regards to claim 6, Mori teaches "the endpoint may be defined when the extent of anisotropy is weaker than a threshold value. The extent of the anisotropy can be quantified in various ways using three eigen values, .lambda..sub.1, .lambda..sub.2, and .lambda..sub.3, such as by calculating the ratio between .lambda..sub.1 and

.lambda..sub.3"(column 5, lines 33-37). The thresholding of the "extent of anisotropy" is used to track strongly aligned fibers (column 5, lines 12-13). Mori goes on to teach that the prominent fiber bundles are color coded (column 5, lines 26-29).

In regard to claims 12 and 20 about tracking a fiber in a specified view in a 3D volume, Mori teaches of a reconstruction of projections of fibers that can be "initiated from a point in 3D space which is arbitrarily selected by a user and propagated in both directions according to the direction of the fiber (the eigen vector associated with the largest eigen value). Each time the tracking leaves a pixel and proceeds to the next pixel, a judgment is made as to whether the fiber is continuous or terminated based on randomness of the fiber orientation of the adjacent pixels." (col 4, lines 6-14).

However, Mori does not describe randomly displacing grid points based on a distribution function. In the same field of endeavor, Pierpaoli et al teach of applying a diffusion weighted MRI acquisition sequence to a region for acquiring diffusion weighted images (DWIs) sufficient for determining the diffusion tensor eigen values and vectors (col 4, lines 38-63). As described in "example 1", Monte Carlo stochastic (i.e. random number) simulations were performed to assess the effect of noise on the various anisotropy indices estimated from the diffusion tensor. This algorithm included simulating noise in the MRI measurement and adding it to the DWI signal intensities based upon a Gaussian distribution, meaning points are moved based upon the distribution function. It would have been obvious to one with ordinary skill in the art at the time the invention was made to incorporate the teaching of Pierpaoli et al to Mori as

both are drawn to imaging brain fibers and utilizing DWIs for determining a diffusion tensor.

4. Claims 2-4, 8, and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori and Pierpaoli et al in further view of Laidlaw et al (US PGPUB 2003/0234781).

Mori and Pierpaoli et al teach of all of the limitations of claim 2 via claim 1 except for displaying the image with opacity values that reflect the diffusion anisotropy values. Laidlaw et al. teaches of a fiber rendering apparatus in which "the primary data can be diffusion tensor data generated by the MRI system from tissue, and the data processor operates to identify directed diffusion paths and to render the directed diffusion paths as thread-like structures" (abstract). Laidlaw et al. goes on to cite Mori as prior art in paragraph 9. Laidlaw et al. discriminates the ellipsoid approach as taught my Mori (column 3, lines 9-39) by saying that by "placing an ellipsoid at every data point in three dimensional space obscures all layers of ellipsoids except the outermost layer" (¶ 13). Laidlaw et al. goes to cite Kindlmann et al. in paragraph 14 by saying their group was able to overcome the problem of obscuring data points by assigning every data point a certain opacity and color based on the underlying diffusion tensor dataset.

Laidlaw et al. describes a need to improve existing methods of fiber rendering, such as Mori. Therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention was made to combine the Mori fiber tracking method and apparatus and the Pierpaoli et al method with the Laidlaw et al. opacity dependent

display in order to overcome the problem of obscuring data points within the tracked fiber. This is allows more data to be visualized by the user.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Rozanski whose telephone number is 571-272-1648. The examiner can normally be reached on Monday - Friday, 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eleni Mantis-Mercader can be reached on 571-272-4740. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MR

ERIC F. WINAKUR
PRIMARY EXAMINER